CLAIMS

Having thus described the invention, what is claimed as new and desirable to be secured by Letters Patent is as follows:

1. A method for separating a semiconductor device from substrate in a fixture having a shearing element where the semiconductor device is attached to the substrate by solder connections to form an assembly, the method comprising:

applying a loading force to drive the shearing element away from its home position to which it is urged by a mechanical biasing force into a loading position,

loading the assembly of the substrate and the semiconductor device into the fixture with the shearing element proximate to the semiconductor device,

removing the loading force to apply a shearing force derived from the mechanical biasing force which is and applied by the shearing element to the semiconductor device, and

heating the solder connections of the assembly in the fixture to a predetermined temperature.

2. The method of claim 1 with the fixture including a top member with a window therethrough for the semiconductor device and the shearing element located below the top member.

3. The method of claim 1 wherein the shearing element comprises a slidable blade.

4. The method of claim 1 wherein the shearing element is a blade affixed to a slidable element that is connected by a linkage to a coil spring which applies the mechanical biasing force thereto.

5. The method of claim 1 wherein the predetermined temperature is below the melting temperature of the solder at which shearing of the solder connections occurs.

6. The method of claim 1 wherein:

the fixture includes a top member with a window therethrough for the semiconductor device and the shearing element located below the top member,

the shearing element comprises a slidable blade,

the slidable blade is affixed to a slidable element that is connected by a linkage to a coil spring which applies the mechanical biasing force thereto,

when the loading force is removed the slidable blade moves from proximate to the chip into contact with the chip thereby applying a shearing force to the chip in response to the biasing force from the coil spring, and

the predetermined temperature at which shearing of the solder connections occurs in response to the shearing force is below the melting temperature of the solder.

7. A method for removing a circuit chip from a substrate in a fixture having a shearing element where the chip is secured to a substrate by bonding elements, comprising:

applying a loading force to move the shearing element from a mechanically biased home position into a loading position against a biasing force,

then loading the substrate with the chip onto the fixture,

removing the loading force to arm the shearing element into a position in contact with the chip, so the biasing force is applied by the shearing element to the semiconductor device, and

heating the assembly located in the fixture to a predetermined temperature until shearing of the bonding elements occurs while continuously applying the mechanical force with the shearing element.

8. The method of claim 7 wherein the shearing element comprises a slidable blade.

9. The method of claim 7 wherein the shearing element is a blade affixed to a slidable element that is connected by a linkage to a coil spring that applies the biasing force thereto.

10. The method of claim 7 wherein the shearing element is a blade affixed to a slidable block that is biased to a home position by a coil spring which applies the biasing force thereto.

11. The method of claim 7 wherein:

the shearing element is a blade affixed to a slidable block which is connected by a screw that is biased to a home position by a coil spring which applies the biasing force thereto, and

an adjustable element is provided for adjusting the bias applied by the coil spring.

12. The method of claim 7 wherein the bonding elements comprise solder and the step is performed of heating the solder to a temperature facilitating shear and removal of the chips from the substrate while the solder is in a solid state.

13. The method of claim 7 wherein the substrate is loaded into a seat in an upper element with the chip extending through a window therein.

14. The method of claim 7 wherein:

the substrate is loaded into a seat in an upper element of the fixture with the chip extending through a window therein,

the shearing element is connected to a slide element that is biased to a home position by a coil spring which applies the biasing force thereto, and

an adjustable element is provided for adjusting the bias applied by the coil spring.

15. The method of claim 14 wherein the slide element includes a nest located below the window adapted and located for catching a chip sheared from a substrate.

16. Apparatus for separating a semiconductor device from a substrate where the semiconductor device is attached to the substrate by solder connections to form an assembly, comprising:

a biasing element for applying a loading force to drive a shearing element away from its home position to which into a loading position under a fixture it is urged by a mechanical biasing element,

a loading element for placing the assembly of the substrate and the semiconductor device into a fixture with a window therethrough for the semiconductor device with the shearing element in contact with the semiconductor device and armed for shearing the semiconductor device from the substrate.

17. The apparatus of claim 19 wherein the shearing element comprises a slidable blade.

18. The apparatus of claim 19 wherein the shearing element is a blade affixed to a slidable element that is connected by a linkage to a coil spring which applies the biasing force thereto.

19. Apparatus for removing a circuit chip from a substrate where the chip is secured to a substrate by bonding elements, comprising:

a biasing element for applying a loading force to move a shearing element from a mechanically biased home position into a loading position under a fixture against a biasing force,

a loading element for placing the substrate with the chip onto the fixture, and

a retaining element for holding the shearing element in a position in contact with the chip, so the biasing force is applied by the shearing element to the semiconductor device.

20. The apparatus of claim 19 wherein the shearing element comprises a slidable blade.

21. The apparatus of claim 19 wherein the shearing element is a blade affixed to a slidable element that is connected by a linkage to a coil spring that applies the biasing force thereto.

22. The apparatus of claim 19 wherein the shearing element is a blade affixed to a slidable block which is connected by a screw that is biased to a home position by a coil spring which applies the biasing force thereto.

23. The apparatus of claim 19 wherein:

the shearing element is a blade affixed to a slidable block that is connected by a screw that is biased to a home position by a coil spring which applies the biasing force thereto, and

an adjustable element is provided for adjusting the bias applied by the coil spring.

24. The apparatus of claim 19 wherein the bonding elements comprise solder adapted to be heated to a temperature facilitating shear and removal of the chips from the substrate while the solder is in a solid state.

25. The apparatus of claim 19 wherein the substrate is loaded into a seat in an upper element with the chip extending through a window therein.

26. The apparatus of claim 19 wherein:

the substrate is loaded into a seat in an upper element with the chip extending through a window therein,

the shearing element is connected to a slide element which is connected by a screw that is biased to a home position by a coil spring which applies the biasing force thereto, and

an adjustable element is provided for adjusting the bias applied by the coil spring.

27. The apparatus of claim 24 wherein the slide element includes a nest located below the window adapted and located in a position for catching a chip sheared from a substrate.

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